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from the monastery of the Holy Grave at Jerusalem. This treatise should be familiar to every teacher of elementary mathematics for it gives us clear insight into the methods of work of the greatest mathematician of antiquity. The theorems of the *Method* are entirely within the grasp of any who have studied analytic geometry. The quadrature of a segment of a parabola and the determination of the volume and surface of a sphere are included in the discussion. Besides the translation published by Heath, an English translation is available in the *Monist* for 1909,[1] a German translation in the *Bibliotheca Mathematica,* Vol. 7, third series, pp. 321–363, 1907, and a French description in the *Revue générale des Sciences,* 1907, as well as the more critical Greek edition for philologists in *Hermes,* 1907, Vol. 42, pp. 235–297. How easily an important work may be lost without any trace of it in literature is evident from this treatise which was formerly known only through a chance reference by Suidas to a commentary on it by Theodosius, and the citation by Heron of three of the theorems (and this latter reference first appeared in print in 1903).

Fragments of the *Stomachion* by Archimedes are also preserved in the Constantinople papyrus. Dr. Kliem has added to his valuable work not only these brief passages on this ancient puzzle but also the more complete information preserved in an Arabic translation and published by Suter in Vol. IX of the *Abhandlungen zur Geschichte der Mathematik.* In this geometrical puzzle some fourteen ivory pieces which fit together to make a square are to be arranged in different ways so as to represent a ship, a sword, and other objects. The name of Archimedes has long been associated with this game but only recently has the definite evidence been obtained showing that the great genius of the Greek world did not disdain mathematical puzzles.

This work can be heartily recommended to all students of mathematics, for Dr. Kliem has made available in one volume the works of Archimedes which have come down to us. The book is also a fine specimen of the printer's art. Of corrections necessary I have noted only on page 429, line 14, reference to "Satz 8," instead of "Satz 9."

LOUIS C. KARPINSKI.

Elementary Theory of Equations. By L. E. DICKSON. John Wiley and Sons, New York, 1914. v+184 pages. $1.75.

This book occupies a middle ground in difficulty, being too advanced for the average freshman, but still of an elementary character, suitable for a second course in the theory of equations. It is such a book as may be read with profit by any one who wants an *exact* statement and rigorous proof of the elementary theorems —not involving group-theory or invariants—concerning algebraic equations; a work of value to all teachers of algebra, whether elementary or advanced. In particular every teacher of algebra should read the proof of the fundamental theorem of algebra and the work on graphing; while every teacher of geometry, should read the proofs given in Chap. VIII relating to the trisection of an angle duplication of the cube, and construction of regular polygons of 7, 9, and 17 sides. An exact treatment of these topics cannot but be of aid to anyone interested in elementary mathematics.

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[1] Republished in pamphlet form by the Open Court Publishing Company.

The early introduction of graphing and the use of derivatives in finding " bend points " enable the writer at the beginning of the book to give a discussion of the discriminant of the cubic $x^3 - 3lx + q = 0$, while the work throughout the book is rendered clear by the use of graphs. In the first chapter we are given also the graphical solution of a quadratic. Complex numbers are next introduced in a soul-satisfying way. This chapter should be read by everyone who thinks that complex numbers are " imaginary " and that we gain nothing by their use except to make certain equations have roots.

" The fundamental theorem of algebra " is also treated in a satisfactory way, the graphical proof being clear and elementary. However it tacitly assumes that if a polynomial in x and y is positive at a point A and negative at a second point B, it will vanish at some point between A and B on any curve joining them—a theorem which might have been explicitly stated, particularly since the corresponding theorem for one variable is carefully given (page 13). Also (page 52, line 13) why the word " perhaps "? " A region or perhaps regions " would convey the meaning better. We must have one such region just as assuredly as a region when Y is positive. In fact the statements about these regions are far from clear and are not proved or carefully explained. But when a proof of this important theorem is given which rests on such elementary principles of algebra and graphics as this one does, surely even minor criticism is ill-timed.

The theorem that an integral root of an equation with integral coefficients divides the constant term might well be supplemented by the similar theorem that if an equation with integral coefficients has a fractional root α/β, α must divide the constant term and β the coefficient of the highest power of x. This gives in general a simpler way to find such roots than that given on page 62.

The treatment of symmetric functions is unusually complete and careful.

The reviewer is glad to see in an accessible place a treatment given to the problems of trisecting an angle and duplicating a cube. These puzzle students and often teachers, partly because the problem is not clearly understood, and partly because there is so obviously a solution; and yet their impossibility may readily be made plausible to a student familiar with coördinate geometry and is here rigorously proved in an elementary way. We are also shown why there can be no construction, in the Euclidean sense, of regular polygons of 7 and 9 sides.

The usual theorems for the isolation of the roots are given in Chap. IX, as well as some theorems that are not found in most textbooks. The use of elementary calculus allows a clear treatment and a complete solution of the problem, " given an equation to locate its real roots," while the methods of Chap. X show how to compute them. Besides Horner's well-known method for the numerical computation of roots, Newton's is given and emphasized as one that is effective for non-algebraic as well as for algebraic equations; and Gräffe's little known but very ingenious scheme of solution by forming equations whose roots are powers of the roots of the given equation, and Lagrange's solution by continued fractions are also explained.

In Chap. XI determinants receive a clear natural treatment, while the subject of resultants and discriminants is carefully and rigorously discussed in the closing chapter.

On the whole in this book there is much to praise and little with which to find fault.

Elijah Swift.

PROBLEMS AND SOLUTIONS.

B. F. Finkel, Chairman of the Committee.

PROBLEMS FOR SOLUTION.

SPECIAL NOTICE. In proposing problems and in preparing solutions, contributors will please follow the form established by the Monthly, as indicated on the following pages.

In particular, a solution should be preceded by the number of the problem, the name and address of the proposer, the statement of the problem, and the name and address of the solver.

The solution should then be given with careful attention to legibility, accuracy, brevity without obscurity, paragraphing and spacing, having in mind the form in which it will appear on the printed page.

Please use paper of letter size, write on one side only, leaving ample margins, put one solution only on a single sheet and include only such matter as is intended for publication.

Drawings must be made *clearly* and *accurately* and an extra copy furnished on a *separate sheet* ready for the engraver.

Unless these directions are observed by contributors, solutions must be entirely rewritten by the committee or else rejected.

Selections for this department are made two months in advance of publication.

Please send all solutions direct to the chairman of the committee.

Managing Editor.

ALGEBRA.

When this issue was made up solutions of 410–19 had been received. Solutions of 406 and 420 are desired.

420. Proposed by ELBERT H. CLARKE, Purdue University.

Given the infinite series,

$$\frac{a}{r}+\frac{b}{r^2}+\frac{a+b}{r^3}+\frac{a+2b}{r^4}+\frac{2a+3b}{r^5}+\cdots,$$

in which a and b are any numbers and where each numerator after the first two is the sum of the two preceding numerators. To find the region of convergence and the sum of the series.

This problem is a generalization of one solved in the January number of the Monthly.

421. Proposed by C. N. SCHMALL, New York City.

Give a trigonometrical solution of the general quadratic equation.

GEOMETRY.

When this issue was made up solutions of 437–38–39–40–43–45–47–48–54 had been received. Solutions of 427–30–32–33–44–46 are desired.

449. Proposed by H. E. TREFETHEN, Colby College.

Find a tetrahedron with the face angles at one vertex in arithmetical progression and its six edges expressed in integers.